

the research to the end; extreme care in observation and strict attention to detail; careful recording of observations, which should be done at the earliest possible moment; thorough belief in the importance of the particular research, amounting even to enthusiasm; conscientiousness.

Many of these desirable qualities will at once commend themselves to you; they need no more than enumeration. But you may wonder why I have set down others of them. For instance, what has conscientiousness to do with research any more than it has to do with any other of the affairs of life? Do I mean that an investigator should be honest and not appropriate or use unfairly the work of other investigators? Oh, no! I assume such honesty as this in every investigator. The conscientiousness of which I speak is of the worker to himself and his own work. In this way. A worker has been engaged in a research during many months. He has made many experiments and observations, and they have all gone to prove the correctness of the result at which he has arrived. But there is still one experiment which it would be well to try. He tries it, and curiously it does not turn out quite right. He puts two and two together and they do not make four. And everyone agrees with "The Professor in the Case" that two and two do make four, "not some times, but all the time." Now is the moment when his conscientiousness should come into play. The temptation is overwhelming to explain the failure by some fault in technique, and to set the result of that experiment on one side rather than to repeat it again and again as he ought certainly to have done. Had he done so it would again have failed, and he would have learned in the end, not that two and two do not make four, but that one of his twos was not a two, and he would have avoided publishing that result of his research which was afterwards discovered to be incorrect by a more careful and conscientious worker. It must always be borne in mind that the mischief of a faulty result does not end with that research, but may be the starting point of a long series of equally faulty results.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

IN his presidential address Colonel Close, the recently appointed Director-General of the Ordnance Survey, raised again the oft-debated question, "What is geography?" His contention that geography, apart from cartography, cannot be treated as a science in itself, but must serve as a common meeting-place and popularising medium for various other sciences, will certainly not be accepted by modern geographers without considerable modification and amplification.

Prof. Herbertson exhibited and explained a new series of thermal maps which he has constructed to show the actual mean temperatures prevailing over the globe instead of the temperatures reduced to sea-level, as indicated on the ordinary meteorological maps. Among other papers on cartography were two by Mr. A. R. Hinks, one dealing with the use of colour on contour maps, and the other with the most suitable projections for atlas maps. Captain Henrici discussed the present state of our knowledge—not altogether satisfactory—of the mean sea-level round our coasts, and arrived at the conclusion that there is no evidence, from the observations made, to justify the belief that mean sea-level is not constant around the British Isles. Captain Henrici also contributed a note on the height of Ruwenzori as determined by him from observations made by Captain Jack. His result is $16,801.3 \pm 5.3$ feet.

Among the papers on physical geography, two of the most interesting were contributed by Prof. J. W. Gregory and Prof. O. Pettersson. The former showed that while waterfalls have generally been regarded as destructive, they may in certain circumstances be constructive and act as agents of deposition instead of denudation. In support of this he instanced certain waterfalls in Dalmatia, Bosnia, and Herzegovina. In the former country, for example, the Kerka Falls are due to a barrier of calcareous tufa which the Kerka River has built across its valley. Prof. Pettersson discussed the deep-water movements in the Skagerrak, and showed that they occurred when the earth

is in perihelion. His theory is that these waves are influenced by the phases of the moon, but still more by its declination and distance from the earth. He also showed that since 1753 the herring fishery on the coasts of Sweden has been most prolific in years of maximum declination and least prolific in years of minimum declination, a result which he attributes to the influence of the movements in the deep water. Captain Rawling gave an account of the British expedition to Dutch New Guinea, and showed some excellent views of the Nassau Range with its precipitous front more than eighty miles in length and from 8000 to 10,500 feet in sheer height.

The work of the section was concluded by an interesting discussion on aeronautical maps. M. Lallemand described the resolutions recently adopted at his suggestion by the Permanent Committee for Aerial Navigation of the Public Works Department of the French Government on the production of an international air-map, and the establishment of marks required by aviators and aeronauts. Captain Lyons followed with certain general suggestions for the construction of aeronautical maps, and in the subsequent discussion several officers of the air battalion and others took part. A full report of this discussion is to be published in *The Geographical Journal*.

MECHANICAL SCIENCE AT THE BRITISH ASSOCIATION.

THE meeting of the Mechanical Science Section of the British Association at Portsmouth, under the presidency of so distinguished a naval architect as Prof. Harvard Biles, was naturally the occasion for a very interesting programme of papers relating to many branches of marine engineering work ranging over a wide field of applied science, and dealing with some of the most important developments which are now engaging the attention of engineers and men of science in this branch of engineering activity.

The programme contained important papers on the rolling of ships, by the president, the gyro-compass, electrical steering and propulsion of ships, and the developments of wireless telegraphy, especially in its relation to naval problems; while in the purely mechanical section the advances in methods of generating motive power were dealt with in a series of related papers on internal-combustion engines and the superheated steam engine. Not only had the members who attended this section an opportunity of hearing these papers and the very interesting discussions to which they gave rise, but all the sections took the opportunity so kindly afforded them by Admiral Sir A. W. Moore of witnessing, from a battleship which carried them into the Solent, a combined attack by numerous torpedo-boats and submarine vessels with as near an approach to the conditions of naval warfare as practicable.

The interest which all members of the association take in the practical applications of scientific discovery to naval matters was manifested by the close attention to the wonderful evolutions and diving performances of the attacking vessels, while the swift and silent attack of the torpedoes, invariably marked by the final dull thud of impact as each one found its mark, gave a thrill of the possibilities of actual warfare not easily forgotten.

Although the proceedings of the section were so largely devoted to naval matters, other subjects of importance also claimed the attention of the members, like the non-stop train, the peculiar corrugations produced on rails by the long-continued passage of trains; while subjects of more general interest were afforded by papers on smoke abatement, and the possibilities of the manufacture of nitrogen products in this country by electric power, a question of great importance in connection with agriculture and the manufacture of explosives.

The discussion between Sections A and G on aerial flight at the Monday's meeting attracted a very large gathering, and has been dealt with in a separate article (September 28, p. 439).

We now turn to a more detailed examination of the papers in their order, and the discussions to which they gave rise. The president's address, on the rolling of ships,

dealt very largely with the question of the effects of the combinations of the natural oscillations of a vessel with the forced oscillations produced by wave systems, which in general produce their most dangerous effects before a permanent régime is established. In spite of the labours of previous investigators, the magnitudes of the oscillations produced in this transition period under various conditions are still to a large extent unknown; and Prof. Biles was able to indicate the methods of the investigation he is making for solving these problems experimentally, but owing to an unfortunate illness these were not completed in time for the meeting.

The important paper on the corrugation of tramway rails, which was brought before the section by Mr. Worby Beaumont immediately after the president's address, gave an interesting account of the phenomena observed on rails in service, and also particulars of an experimental investigation by the author on the contact areas between loaded wheels and rails, which enable conclusions to be drawn as to the intensities of the compressions and tensions produced by wheels rolling on rails of differing degrees of hardness. In the discussion which followed, Mr. Alexander Siemens suggested the use of hard metal for the sides of the rail with a softer metal composing the head; he considered that a reduction of speed and weight, and the use of larger wheels, such as the author suggested, were impossible under modern conditions. Sir William White gave particulars of the wear of rollers due to gun fire in turrets, and could not agree with Mr. Siemens's suggestion of a composite rail, while in reply the author defended his proposals. The proceedings on Thursday concluded with a paper on the Anschütz gyro-compass by Mr. Elphinstone, accompanied by a demonstration on a machine which was on view during the remainder of the meeting.

This instrument depends for its action on the precession effect of a rapidly rotating wheel due to the influence of gravity and its movement over the surface of the earth, and this effect is utilised for the purpose of a compass by employing a gyroscope running at 20,000 revolutions per minute, and floating in a mercury bath. The precession effect tends to cause the axis of the rotating mass to lie in the plane of the meridian, and hence true north is obtained. Unfortunately, time did not permit of a discussion on this paper.

The first paper at Friday's meeting of the association dealt with the question of electric drives for screw propellers, and Mr. Mavor advocated the use of steam turbines or internal-combustion engines running at a high speed and coupled to a generator. The current so obtained is used to drive a motor on a slow-speed propeller shaft, and the author claimed for this arrangement a high efficiency of power-generating plant and propeller, with an increased flexibility in the system, which offered great advantages and increased economies beyond those given by existing systems in many kinds of vessels. The president, Sir William White, Prof. Dalby, and others took part in a detailed technical discussion, in which the progress in the design of electric generators and propellers for ships and the uses of the author's system were clearly indicated.

A second paper on electrical steering, by Mr. Haigh, described an arrangement of a constantly running motor operating the steering gear by magnetic face clutches, an arrangement which allows of an extremely sensitive regulation of the rudder with great economy of power, since the motor may, if required, be run from the lighting circuit of the ship. Sir William White in opening the discussion said that he viewed electrically operated steering gears with much favour. The sensitiveness of the control was remarkable, almost too much so for the ordinary quartermaster, who would never let the helm alone, although this incessant movement had no real value in keeping the vessel to her course; as a consequence, it had been found necessary to provide hunting-gear to diminish the sensitiveness of electric steering gears. Mr. Hawksley pointed out how very necessary it was still to provide auxiliary hand gear for emergencies.

The next paper, by Mr. T. F. Wall, on the repulsion motor, was essentially mathematical, and after a short discussion upon it by Mr. Haigh, Captain Sankey and Mr. Pollard Digby read a paper on a study of human susceptibility to vibration by aid of an instrument consisting

essentially of a small mirror centred on a fine spindle and floating in a mercury bath. When the mercury is set in vibration by any disturbance, it causes the mirror to oscillate and throw a spot of light on a screen. The authors pointed out that the effects of vibration on individuals depend to a large extent on the frequency as well as on the amplitude, and that the perceptive faculty is very variable and often untrustworthy, points also emphasised by Sir William White and Prof. Petavel, the latter pointing out that the association of sound and mechanical vibration had in general a very disturbing effect on individuals.

A paper on some new aluminium alloys, by Prof. Wilson, concluded Friday's proceedings, and in the absence of the author was taken as read.

The section, which met again on Monday, devoted a couple of hours to a joint discussion on aeronautics with Section A, of which an account has been given already, and on its conclusion Prof. Howe gave a very striking demonstration of the recent developments in wireless telegraphy by aid of an aerial running from the top of the Town Hall into the lecture-room. With the aid of a Brown telephonic relay the audience was able to follow the time signals sent out from Wilhelmshaven, and to distinguish these from signals from other stations like that on the Eiffel Tower. In his paper the author dealt very fully with the improvements which have been made to prevent interference, and in a succeeding paper Captain Sankey described a portable wireless plant of the Marconi Company adapted for carriage on horseback, and capable of erection in a few minutes for use up to 100 miles. A short discussion by Profs. Dalby and Howe and Mr. Kilburn Scott concluded the day's proceedings.

On Tuesday three papers dealing with some modern methods of generating power were grouped together for discussion. Mr. Marshall described the special features and merits of the superheated over-type steam engine, Mr. Tookey gave a careful analysis of the costs of power production with suction gas engines, and Mr. Day gave a similar analysis for Diesel engines. The long and detailed discussion which followed was of the greatest interest, and was prolonged much beyond the time originally fixed for its termination. Mr. Rosenthal, who followed with a paper on marine oil engines, dealt with the most recent developments in this important subject; and the discussion, in which the president, Sir William White, Mr. Day, and Mr. Rosenthal joined, was chiefly remarkable in showing how confident these authorities are in the continuance of the supremacy of the steam turbine in naval work for many years to come.

An overflow meeting on Wednesday was devoted to three papers of a more general nature and of great interest.

Mr. Kilburn Scott described the manufacture of nitrogen products by electric power, and particularly emphasised the importance he attached to this country's possessing the means for manufacturing all the nitrogen compounds required for explosives, and the danger of depending on foreign supplies in times of war. Sir William Ramsay agreed with the author that it was most desirable to locate factories in the neighbourhood of coal mines, and Sir William White expressed his general agreement with the author's views, although he did not consider that the present impossibility of manufacturing all the essential constituents of explosives in this country was a national danger. Prof. Petavel discussed the efficiency of the electric process, and Mr. Wimperis suggested the utilisation of the waste gases from blast furnaces for the process, and estimated the power available. In the following paper, on smoke abatement, by Dr. J. S. Owens, the fixing of a new standard of smoke emission from factory chimneys was suggested, and an instrument for measuring smoke density was exhibited. After a spirited discussion the final paper of the section was read by Mr. Yorath Lewis, on a new system of continuous transportation for passenger and other train services.

The distinctive feature of the system is an endless screw of variable pitch, which enables the speed of passenger carriages to be varied at will, while the energy now lost in stopping trains by brakes is given back to the screw during the retardation, thereby avoiding a large waste of power when stations are frequent. The author enumerated many other advantages of his system, among which were

included the abolition of signalling arrangements, increased mean speed of travelling, and increased comfort due to more gradual acceleration and retardation of the train.

Owing to the late hour only a brief discussion was possible; and a very successful meeting terminated with votes of thanks to the president and vice-presidents.

E. G. COKER.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

NOTWITHSTANDING the comparatively small numbers attending the meeting of the association at Portsmouth, the audiences in Section H, which met under the presidency of Dr. W. H. R. Rivers, F.R.S., were well up to the average, at any rate in the morning sessions. In the afternoons the attendances were sometimes small, owing, no doubt, to the attractive nature of the local arrangements for the entertainment of members. In the circumstances it was thought advisable to abandon the sectional meeting on the afternoon of the naval display, and to adopt the unusual course of holding an evening session. The wisdom of the change was made apparent by the large audience which listened to the postponed papers by Mr. R. R. Marett and Prof. A. Keith.

The papers communicated to the section attained a uniformly high level: some may be counted as of first importance; and it is perhaps not unsafe to say that the discussions on totemism and on the institution of an Imperial Bureau of Anthropology will be of far-reaching effect.

The discussion on totemism, to which the whole of a morning session was devoted, was opened by Dr. A. C. Haddon, who explained that totemism was usually regarded as the association of definite human groups with non-human groups. After citing typical instances, he pointed out that even in Australia there was much variation, and other customs and beliefs might be present. Similar variability also obtained in other parts of the world, so that it had become extremely difficult to frame a definition of totemism that would hold good everywhere. Although it was primarily a social and not a definitely religious institution, in most cases it could not be distinguished from a religious sentiment. Dr. A. A. Goldenweiser remarked that all attempts to characterise totemism by a more or less definite set of features must needs be artificial. Consequently, its distinctive characteristics were not the individual features, but the relation into which they entered. Dr. Graebner, whose paper, in the unavoidable absence of the author, was read by the president, said that every attempt to account for the origin of totemism must first deal with the question whether this institution was a cultural entity, for if it were once conceded that the form of totemism found in different parts of the earth had arisen independently, there could be no justification for the assumption that it had had everywhere the same origin. An examination of the evidence from the South Seas, from Africa, from South and North America, and from Asia would appear to show that this was the case; there were no older forms from which group totemism could be derived. In the older form, in which totems were animals, there was an indefinite and unstable relation of sympathy between man and beast which could be explained simply by certain groups of men and animals having co-existed locally in a region of diversified physical character. Prof. Hutton Webster in his paper on the relations between totem clans and secret societies pointed out that secret societies, although acting as a native police in West Africa and Melanesia, were not consciously devised for this purpose. Investigation revealed the importance of the part played by them in funeral rites, and especially in initiation ceremonies at puberty. These and other features appeared to be closely connected with the structure and function of totemic clans, and he suggested that they had been transferred to the secret society in the course of the disintegration of ancient totemic groupings. In discussing methods of investigation, Prof. E. Waxweiler said that light could only be thrown on the question of totemism by the application of a scrupulously accurate method of analysis, which should be mainly sociological, i.e. it should consider the so-called totemic facts as being

imposed by the conditions of organised social life amongst men. Further, its starting point should be "functional", it must search for the social function from which totemism had sprung. Analysing the phenomena of totemism on these lines, it would appear that functionally it was a social device for sanctioning permanent situations, which were considered essential or peculiar in the organisation of the group, wherein individuals, or more frequently groups of individuals, appeared to remain.

The discussion on an Imperial Bureau of Anthropology was opened by a paper by Mr. J. Gray, who dealt specifically with the anthropometric work which might be carried out under the supervision of such a bureau, and laid stress upon its importance not only to the man of science but to the statesman and social reformer. Mr. T. C. Hodson, in a paper dealing with the ethnographic side of the work, gave an account in outline of the ethnographic and linguistic investigations instituted by the Government in India, the Sudan, and southern Nigeria, and dwelt on the importance of the extension and organisation of such work through a central body as a means of securing sympathetic administration of the affairs of dependent races and of ensuring that they should be trained on right lines to take their place as constituent parts of the Empire. In the discussion which followed the reading of the papers, Prof. J. L. Myres made a detailed survey of the efforts of the British Association at various times to obtain the cooperation of the Government, and expressed a hope that urgent pressure might bring Government departments and public opinion to a sense of the responsibility of this country for a proper record of our own population and of the ways of life of our large masses of native dependents abroad. Prof. Ridgeway recalled the memorials which had been presented to the Government by the Royal Anthropological Institute, and emphasised, by an apt citation of Mr. Crooke's paper on the cow in India, the importance to administrators and commercial men of the information concerning customs and beliefs which such a bureau would make accessible. The Rev. Dr. Bryce explained the organisation of the Canadian Ethnographical Survey, which had been set up as a department of the Geological Survey as a result of the representations made to the Canadian Government by the association at its Winnipeg meeting, and Prof. Hutton Webster gave a brief description of the work of the United States Bureau of Ethnology.

Among the remaining contributions to the proceedings, archæology held first place in point of numbers, although papers of an ethnographical character were more numerous than they had been for the last few years. With one exception, however, these dealt with particular points of research, and were not generally descriptive of a geographical or cultural area. The exception was Captain Rawling's account of the tribes of the Mimika district, of the tribes of the sea coast, and of the Tapiro pygmies encountered by the recent expedition to Dutch New Guinea, which is likely to provide ethnologists with material for discussion for some time to come. Mr. Crooke's paper on the reverence for the cow in India attributed the recent extension of the recognition of the sanctity of the cow, which had existed in a more restricted degree since Indo-Iranian times, to the rise of Neo-Brahmanism. Prof. Hutton Webster's paper on the origin of rest-days proffered an elucidation of Hebrew and Babylonian Sabbatical observances by bringing them into relation with the periods of communal cessation from work and of fasting, as a protective or conciliatory measure, among lower races on critical, usually seasonal, occasions. Mr. Hobley's account of the religious beliefs of the Akikuyu and Akamba of British East Africa dealt, among other matters of belief and ritual, with the *Thahu*, an analogue of the mediæval curse, and its effect on social custom and culture. Major A. J. N. Tremearne described the customs and beliefs of the Hausas in so far as these may be deduced from, or illustrated by, an analysis of their legends and folklore. Dr. C. G. Seligmann raised many points of interest in his important paper on the divine kings of the Shilluk. It is noteworthy that these kings, who trace their descent from Nyakan, a semi-divine founder, are sacrificed ceremonially when they become senile or